

REL Appalachia Ask A REL Response

Family and Community Engagement, Math
July 2020

Question:

What are evidence-based, hands-on math activities elementary and middle school students can complete with parents or caregivers at home during the summer months?

Response:

Thank you for your request to our REL Reference Desk regarding evidence-based information about hands-on math activities that can be completed at home. Ask A REL is a collaborative reference desk service provided by the 10 Regional Educational Laboratories (RELs) that, by design, functions much in the same way as a technical reference library. Ask A REL provides references, referrals, and brief responses in the form of citations in response to questions about available education research.

Following an established REL Appalachia research protocol, we searched for peer-reviewed articles and other research reports on hands-on math activities for elementary and middle school students. We focused on identifying resources that specifically addressed hands-on math activities that can be completed with parents or caregivers at home during the summer months. The sources included ERIC and other federally funded databases and organizations, research institutions, academic research databases, and general Internet search engines. For more details, please see the methods section at the end of this document.

The research team did not evaluate the quality of the resources provided in this response; we offer them only for your reference. Also, the search included the most commonly used research databases and search engines to produce the references presented here, but the references are not necessarily comprehensive, and other relevant references and resources may exist. References are listed in alphabetical order, not necessarily in order of relevance.

References

Dearing, E., Casey, B. M., Ganley, C. M., Tillinger, M., Laski, E., & Montecillo, C. (2012). Young girls' arithmetic and spatial skills: The distal and proximal roles of family socioeconomic and home learning experiences. *Early Childhood Research Quarterly*, 27(3), 458–470. Abstract retrieved from <https://eric.ed.gov/?id=EJ974458>; full text available at <http://www.bclearninglab.bc.edu/downloads/Young%20Girls'%20Spatial%20Abilities.pdf>

From the abstract: “The present study addressed girls’ ($N = 127$) early numerical and spatial reasoning skills, within the context of a critical environment in which these cognitive skills

develop, namely their homes. Specifically, proximal links between distal family socioeconomic conditions and first-grade girls' arithmetic and spatial skills were examined (mean age = 6.72 years; SD = 0.34). The proximal roles of two factors were considered: the general learning characteristics of girls' homes, and the kinds of math and spatial learning activities in which girls participated. General quality of the home learning environment and specific math activities mediated the relation between family socioeconomics and girls' arithmetic skills. In contrast, socioeconomics and home learning experiences were related to girls' spatial skills indirectly only through their verbal skills; spatial activities were not proximal predictors of spatial skills. For both arithmetic and spatial skills, mothers' spatial skills were a strong predictor. Future research and intervention implications of these findings are discussed."

Goldman, S., & Booker, A. (2009). Making math a definition of the situation: Families as sites for mathematical practices. *Anthropology & Education Quarterly*, 40(4), 369–387. Abstract retrieved from <https://eric.ed.gov/?id=EJ866157>; full text available at http://www.life-slc.org/nsf/linkd/files/Goldman_Booker-Making%20Math%20a%20Definition%20of%20the%20Situation%20Families%20as%20Sites%20for%20Mathematical%20Practices.pdf

From the abstract: "We present three cases showing families' competence in mathematical problem solving as a practical aspect of daily life. At home, parents and children engaged creatively in solving math-relevant problems. They used a combination of everyday practices and school forms, but generally did not recognize mathematics in their problem solving. The findings invite new forms of participation that bring families into discussions of math-relevant situations and relates them to their children's school math."

Kliman, M. (2006). Math out of school: Families' math game playing at home. *School Community Journal*, 16(2), 69–90. <https://eric.ed.gov/?id=EJ794799>

From the abstract: "This study investigated the potential of an approach to involving families in regular integration of math into home life, addressing the following: When families are given math-related games unconnected with children's school, does what parents believe impact the extent to which their families play the games, and how do parents describe their family's learning with the games? We distributed games integrating math and U.S. geography to 30 parents with children aged 7 to 13. Over four months, we followed the extent and nature of families' playing of the games. Families with children under 10 were more likely to continue playing over time; parent education and occupation did not relate to extent of play. Parents described a rich, shared educational experience that they and their children shaped to their interests and interaction styles; some drew a sharp contrast with homework. Although all parents believed the games promoted learning, only one related this learning to potential benefit in school. In light of parents' stated distinction between educational game playing at home and homework, we conclude by considering ways to establish and investigate the impact of a culture of families' engaging in math-related activities for fun at home."

Pattison, S., Rubin, A., & Wright, T. (2017). *Mathematics in informal learning environments: A summary of the literature*. Math in the Making, TERC and the Institute for Learning Innovation.

https://www.informalscience.org/sites/default/files/InformalMathLitSummary_Updated_MinM_03-06-17.pdf

From the report: “Research on mathematical reasoning and learning has long been a central part of the classroom and formal education literature (e.g., National Research Council, 2001, 2005). However, much less attention has been paid to how children and adults engage with and learn about math outside of school, including everyday settings and designed informal learning environments, such as interactive math exhibits in science centers. With the growing recognition of the importance of informal STEM education (National Research Council, 2009, 2015), researchers, educators, and policymakers are paying more attention to how these experiences might support mathematical thinking and learning and contribute to the broader goal of ensuring healthy, sustainable, economically vibrant communities in this increasingly STEM-rich world. To support these efforts, we conducted a literature review of research on mathematical thinking and learning outside the classroom, in everyday settings and designed informal learning environments. This work was part of the NSF-funded Math in the Making project, led by TERC and the Institute for Learning Innovation and designed to advance researchers’ and educators’ understanding of how to highlight and enhance the mathematics in making experiences. Recognizing that the successful integration of mathematics and making requires an understanding of how individuals engage with math in these informal learning environments, we gathered and synthesized the informal mathematics education literature, with the hope that findings would support the Math in the Making project and inform the work of mathematics researchers and educators more broadly.”

Additional Ask A REL Responses to Consult

Ask A REL Appalachia at SRI International. (2020). *What are effective approaches or strategies for promoting community and family engagement in math learning in elementary school? What is the impact of community and family engagement on math outcomes?* Retrieved from <https://ies.ed.gov/ncee/edlabs/regions/appalachia/askarel/aar85.asp>

Additional REL Resources to Consult

Regional Educational Laboratory Appalachia, Central, and Northwest, Teaching Math to Young Children for Families and Caregivers:

<https://ies.ed.gov/ncee/edlabs/regions/central/resources/teachingearlymath/index.asp>

From the website: “These family and caregiver resources and activities, organized by math topics such as counting or shapes, include research-based and easy-to-follow steps to help you support your child’s math skills during a typical day.”

Regional Educational Laboratory Appalachia, Community Math Nights Partnership:

https://ies.ed.gov/ncee/edlabs/regions/appalachia/partners-community_math-nights.asp

From the website: “Stakeholders across the region expressed a need for families and the broader community to recognize the importance of math for future education and workforce

success and to be able to support children in math learning and in the development of positive math attitudes. To begin to address this need, REL AP collaborated with educators to develop and implement community math nights that engage participants in hands-on activities that support children’s math learning and help children develop a growth mindset related to math ability.”

- Community Math Night Facilitator Guide:
https://ies.ed.gov/ncee/edlabs/regions/appalachia/events/materials/4_10_19_MathNights-REL-AP_FacilitatorsGuide_508.pdf

Regional Educational Laboratory Northwest, Finding Math Around You:

<https://www.youtube.com/watch?v=48k9WNuO1Hw>

From the video description: “This REL Northwest video explores evidence-based strategies for helping kids learn to love math and view and describe their world mathematically.”

Methods

Keywords and Search Strings

The following keywords and search strings were used to search the reference databases and other sources:

- math AND (“hands-on activit*” OR “hands-on” OR activit* OR “informal learning” OR manipulative* OR game*) AND (elementary OR “middle school” OR “middle grade*”) AND (home OR summer OR “out-of-school”)

Databases and Resources

We searched ERIC, a free online library of more than 1.6 million citations of education research sponsored by the Institute of Education Sciences (IES), for relevant resources. Additionally, we searched the academic database ProQuest, Google Scholar, and the commercial search engine Google.

Reference Search and Selection Criteria

In reviewing resources, Reference Desk researchers consider—among other things—these four factors:

- Date of the publication: Searches cover information available within the last 10 years, except in the case of nationally known seminal resources.
- Reference sources: IES, nationally funded, and certain other vetted sources known for strict attention to research protocols receive highest priority. Applicable resources must be publicly available online and in English.
- Methodology: The following methodological priorities/considerations guide the review and selection of the references: (a) study types—randomized controlled trials, quasi

experiments, surveys, descriptive data analyses, literature reviews, policy briefs, etc., generally in this order; (b) target population, samples (representativeness of the target population, sample size, volunteered or randomly selected), study duration, etc.; (c) limitations, generalizability of the findings and conclusions, etc.

- Existing knowledge base: Vetted resources (e.g., peer-reviewed research journals) are the primary focus, but the research base is occasionally slim or nonexistent. In those cases, the best resources available may include, for example, reports, white papers, guides, reviews in non-peer-reviewed journals, newspaper articles, interviews with content specialists, and organization websites.

Resources included in this document were last accessed on June 30, 2020. URLs, descriptions, and content included here were current at that time.

This memorandum is one in a series of quick-turnaround responses to specific questions posed by education stakeholders in the Appalachia region (Kentucky, Tennessee, Virginia, and West Virginia), which is served by the Regional Educational Laboratory Appalachia (REL AP) at SRI International. This Ask A REL response was developed by REL AP under Contract ED-IES-17-C-0004 from the U.S. Department of Education, Institute of Education Sciences, administered by SRI International. The content does not necessarily reflect the views or policies of IES or the U.S. Department of Education, nor does mention of trade names, commercial products, or organizations imply endorsement by the U.S. government.